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<p>(21) International Application Number: PCT/EP99/10248</p> <p>(22) International Filing Date: 21 December 1999 (21.12.99)</p> <p>(30) Priority Data: VE98A000048 23 December 1998 (23.12.98) IT</p> <p>(71) Applicant (for all designated States except US): TRAFILERIE DI CITTADELLA S.P.A. [IT/IT]; Via Mazzini, 57, I-35013 Cittadella (IT).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): ROCCO, Elio [IT/IT]; Via Mazzini, 57, I-35013 Cittadella (IT).</p> <p>(74) Agent: PIOVESANA, Paolo; Corso del Popolo, 70, I-30172 Venezia Mestre (IT).</p>		<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
<p>(54) Title: METHOD FOR PRODUCING OPEN CORED WIRE FOR ELECTRIC ARC WELDING, AND PLANT FOR IMPLEMENTING THE METHOD</p> <div data-bbox="295 1171 1263 1318"> </div> <p>(57) Abstract</p> <p>A method for producing open cored wire for electric arc welding, in which a metal strip is subjected to a preliminary shaping stage to make it assume a concave profile suitable for filling with a welding powder mixture, said strip preliminary shaped in this manner then being filled with said powder mixture, and then subjected to a final shaping stage to join the longitudinal edges of said strip filled in this manner, to obtain an open cored wire which on termination of the process is fed to spooling and packaging, characterised by subjecting to said preliminary shaping stage a steel strip with a surface coating of a metal having a hardness less than and a coefficient of electrical conductivity greater than those of steel, then spooling and packaging the cored wire directly obtained from said final shaping stage.</p>		

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METHOD FOR PRODUCING OPEN CORED WIRE FOR ELECTRIC ARC WELDING, AND PLANT FOR IMPLEMENTING THE METHOD

This invention relates to a method for producing open cored wire for electric arc welding, and a plant for implementing the method.

5 Cored wire for electric arc welding is known. It is in the form either of open cored wire (non-welded) or closed cored wire (welded), depending on the method used for its production. Open cored wire is generally produced starting from steel strip which is firstly shaped to assume a U cross-section, then filled with a traditional powder mixture the purpose of which is to protect
10 the welding arc and to modify the quality of the steel forming the wire and of the materials to be welded. The strip shaped in this manner is then subjected to further shaping by which the two longitudinal edges of the strip are either brought into mutual contact or superimposed or clinched together, after which the cored wire obtained in this manner is rolled and drawn to attain its
15 required diameter.

Closed cored wire is also produced from steel strip, which is firstly shaped into a tube, is then welded along the contacting longitudinal edges, and is finally filled with the protective powder mixture.

Independently of whether the cored wire is open or closed, during its
20 shaping the steel strip is treated with liquid, powder or mixed lubricants, which facilitate the process. At the end of this process they have to be removed as they are detrimental to the welding, this removal being done by treatment in a bath in the case of closed wire, or by drying at high temperature (about 300°C) in the case of open wire, which cannot withstand immersion in the
25 bath.

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After the outer surface of the cored wire has been perfectly cleaned, other lubricants not detrimental to welding can be applied to it to facilitate wire preservation and its sliding through the sheath of the welding machine.

Instead of applying these lubricants to the cored wire it can be
5 subjected to external copper, zinc or bronze plating to obtain the same advantage obtainable with the lubricants plus the advantage of better current passage given the high electrical conductivity of this coating material.

However this copper, bronze or other plating treatment represents a chemical or electrolytic treatment which in all cases is carried out after the
10 shaping process and after the removal of the lubricants required for this process, and can be effected only on closed cored wire in that it requires the wire to be immersed in a bath, which in the case of open wire would inevitably damage the powder.

An object of the invention is to produce open cored wire provided with
15 surface copper, bronze, zinc or other protective plating.

A further object is to produce open cored wire in a more rapid and economical form than otherwise achievable.

A further object is to provide open cored wire in which different extents of copper plating can be effected on its outer and inner surface.

20 These and further objects which will be apparent from the ensuing description are attained according to the invention by a method for producing open cored wire for electric arc welding as claimed in claim 1.

To implement the method, the invention proposes a plant as claimed in claim 7.

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A preferred embodiment of the invention is described in detail hereinafter with reference to the accompanying drawing, which shows a schematic view of a plant according to the invention.

As can be seen from the drawing, the method of the invention is implemented within a line comprising a reel 2 on which a coil of steel strip 4 of characteristics corresponding to the cored wire to be produced is mounted, and a multi-station shaping line, with a first station 6 in which the strip is progressively shaped to assume a concave form suitable for receiving a traditional powder mixture in a filling station 8, and with a second station 10 in which the preshaped and filled strip 4 is transformed into a continuous tubular element, as the result of bringing the two longitudinal edges into mutual approach to an extent sufficient to retain the powder mixture.

In contrast to known production lines for open cored wire, in the line which implements the method of the invention there is provided upstream of the first shaping station 6 a copper plating station 12 for the steel strip 4, which consequently arrives at the entry to said first shaping station 6 provided on both surfaces with a copper coating.

This coating can be obtained chemically or electrolytically, by traditional methods.

Hence at the exit of the second shaping station 10 an open cored wire is obtained formed of copper plated steel strip enclosing in its interior the powder mixture, and ready to be wound into a spool.

The fact that the steel strip subjected to shaping has been previously copper plated has considerable advantages, and in particular:

- it enables open cored wire to be produced, this being a product easier to make than closed cored wire,

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- it also uses the copper as lubricant during shaping and/or rolling, in place of traditional lubricants (stearates), hence eliminating substances which are a cause of impurities in the deposited material and can result in hot cracks in the weld seam,
 - 5 - it enables different extents of copper plating to be achieved on the two surfaces of the cored wire, so making it easier to control the copper quantity within the tolerances prescribed by international specifications for this type of wire,
 - it improves electrical contact during welding.
- 10 Instead of subjecting the steel strip to copper plating, it can be subjected to other coating treatment (for example bronze plating, zinc plating, etc.) with a different material having a hardness less than steel, to facilitate both the shaping of the steel strip and the sliding of the cored wire through the sheath of the welding machine, while at the same time having a better
- 15 coefficient of electrical conductivity than steel to improve electrical contact during welding.

 Again according to the invention, instead of starting with a steel strip to be subjected to protective metal coating prior to shaping, an already coated steel strip can be used as the raw material, obtained for example by rolling a

20 steel rod coated with the protective metal.

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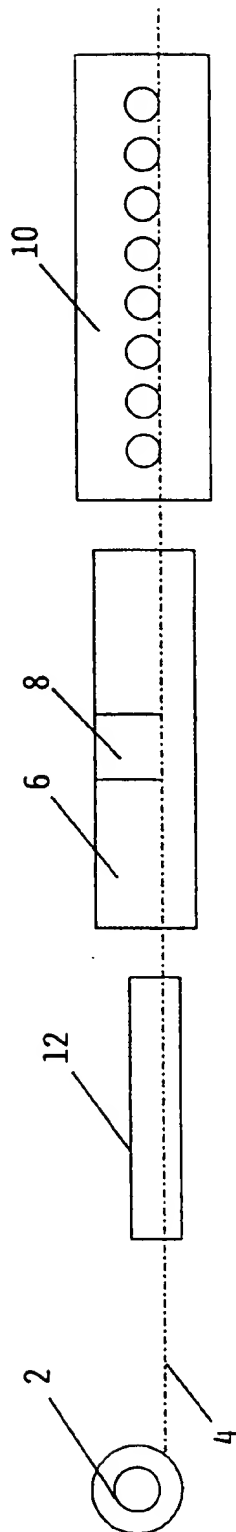
C L A I M S

1. A method for producing open cored wire for electric arc welding, in which a metal strip is subjected to a preliminary shaping stage to make it assume a concave profile suitable for filling with a welding powder mixture,
5 said strip preliminarily shaped in this manner then being filled with said powder mixture, and then subjected to a final shaping stage to join the longitudinal edges of said strip filled in this manner, to obtain an open cored wire which on termination of the process is fed to spooling and packaging, characterised by subjecting to said preliminary shaping stage a steel strip with
10 a surface coating of a metal having a hardness less than and a coefficient of electrical conductivity greater than those of steel, then spooling and packaging the cored wire directly obtained from said final shaping stage.
2. A method as claimed in claim 1, characterised by using a copper plated steel strip.
- 15 3. A method as claimed in claim 1, characterised by using a bronze plated steel strip.
4. A method as claimed in claim 1, characterised by using a zinc plated steel strip.
5. A method as claimed in claim 1, characterised by subjecting a steel
20 strip to chemical coating immediately before subjecting it to the preliminary shaping stage.
6. A method as claimed in claim 1, characterised by subjecting a steel strip to electrolytic coating immediately before subjecting it to the preliminary shaping stage.
- 25 7. A plant for implementing the method claimed in one or more of claims 1 to 6, comprising a steel strip unwinding station (2), a preliminary shaping

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station (6) for giving the strip a concave profile suitable for filling with powder, a filling station (8) for said concave strip, and a final shaping station (10) for joining the longitudinal edges of said strip and for rolling it and drawing it to attain the predetermined diameter, characterised in that between the steel
5 strip unwinding station (2) and the preliminary shaping station (6) there is provided a station (12) for coating said strip with a layer of metal having a hardness less than and a coefficient of electrical conductivity greater than those of steel, immediately downstream of said final shaping station (10) there being provided a spooling station.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B23K35/40

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B23K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 002, no. 148 (C-030), 9 December 1978 (1978-12-09) & JP 53 112239 A (MATSUSHITA ELECTRIC IND CO LTD), 30 September 1978 (1978-09-30) abstract	1,2,5-7
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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International Application No

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